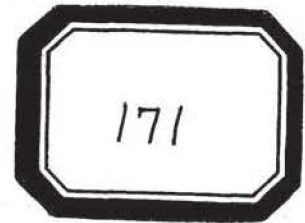


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ESTABLISHMENT REPORT
CHERMES TREND PLOTS IN CRATER LAKE
NATIONAL PARK, OREGON

by

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The balsam woolly aphid, Chermes piceae, is a microscopic insect native to Europe. This pest of true firs was first found on the Pacific Coast in 1928 in the San Francisco Bay area.^{1/} Since then, outbreaks have been found in the Pacific Northwest in forest stands of Pacific silver fir, Abies amabilis; grand fir, A. grandis; and subalpine fir, A. lasiocarpa. Damage was first noticed in grand fir stands in Oregon's Willamette Valley.^{2/} Next, outbreaks were discovered in Pacific silver fir near Mt. St. Helens, Washington and Black Rock, Oregon and in subalpine fir in the Cascade Mountain Range in Oregon. At the present time, infestations of the balsam woolly aphid or Chermes are progressing southward in the Cascades of Oregon towards the southern range of subalpine fir. Aphid populations on Pacific silver fir and grand fir are somewhat static.

In the southern part of its range, subalpine fir grows in mixed stands with red fir, A. magnifica; Shasta red fir, A. magnifica shastensis; noble fir, A. procera; white fir, A. concolor; and grand fir. These other species extend into northern California where they are important commercially. The balsam woolly aphid may become a serious problem in these mixed stands if infestations on subalpine fir constantly subject the other true fir species to heavy Chermes populations.

^{1/} Annand, P. N. A contribution toward a monograph of the Adelginae (Phylloxeridae) of North America. Palo Alto, Calif, Stanford Univ. Press, 146 pp., 1928.

^{2/} Keen, F. P. Insect enemies of western forests. U.S. Dept. Agr. Misc. Pub. 273, 280 pp., illus., 1938,

In 1963 and 1964, mixed true fir stands containing aphid-infested subalpine fir were found in Crater Lake National Park. Infestations in this area in southern Oregon afforded a good opportunity to assess Chermes damage in mixed stands.

OBJECTIVES

In September 1964, trend plots were established at three different locations within Crater Lake National Park to help determine:

- (1) If the balsam woolly aphid will damage Abies spp. other than subalpine fir in southern Oregon.
 - A. Will branches of other species become gouted?
 - B. Will bole infestations subsist on other species?
- (2) The percentage of subalpine fir killed before the infestation subsides.
- (3) The percentage of other Abies spp., if any, that is killed.
- (4) By tree species what crown classes are killed.

METHODS

During the week of September 14-18, 1964, Dr. R. G. Mitchell, Entomologist, Division of Forest Insect Research, Pacific Northwest Forest and Range Experiment Station, and P. E. Buffam, Entomologist, Insect and Disease Control Branch, Division of Timber Management, Regional Office, surveyed southern Oregon by automobile to attempt to determine the southernmost limit of Chermes in Oregon. At this time, several areas within Crater Lake National Park were examined and three were selected as potential study areas. A stand near Copeland Creek was the northernmost area selected and had a very heavy infestation of Chermes on subalpine fir. Some tree killing was evident. The second area near Trapper Creek, which is located south of the Copeland Creek area. Here, Chermes populations were low and probably just beginning. A stand near Red Blanket Creek--south of the other two areas--was selected as the third area. No Chermes was found on any trees at this location. Stands in all three areas contained both subalpine fir and Shasta red fir (possibly noble fir).

From September 22-25, 1964, Regional Office personnel established and rated Chermes trend plots in these three areas. At each location, center lines were run using a staff compass and chain. Plot posts were

placed at 50-foot intervals along this line. On the Copeland Creek and Trapper Creek plots, all true firs within one-half chain (33 feet) of either side of the center line were marked with aluminum tags until 100 trees were obtained (see plot installation maps). On the Red Blanket Creek plot, two separate lines were run, and all true firs within one chain (66 feet) of either side of each center line were tagged. Trees were more widely spaced on this plot. Only trees of four inches D.B.H. or more were selected.

After the 100 trees were tagged, each tree was examined and the following recorded:

- | | |
|--------------------------------|-----------------------|
| (1) Species | (5) Gouting intensity |
| (2) D.B.H. | A. None |
| (3) Crown class | B. Light |
| (4) Bole infestation intensity | C. Moderate |
| A. None | D. Heavy |
| B. Light | (6) Percent top kill |
| C. Moderate | |
| D. Heavy | |

Bole infestations on subalpine fir usually begin in the upper crown and proceed downward and cannot be seen easily with the naked eye until the tree is infested near the base. Therefore, binoculars were used to rate infestation intensity, gouting intensity, and percent top kill. Gouting is extremely hard to classify on subalpine fir even with binoculars. It is questionable whether observers can classify gouting satisfactorily without a great deal of experience.

The three plots were established in four days including travel time to and from Portland. Annual examination of plots should require about three days including travel time for a two-man crew. Seasonal assistants can rate the plots after a brief orientation of the characteristics of bole infestations, gouting and top kill--categories that should be estimated annually. As previously mentioned, however, observers may not be able to estimate gouting without prior experience.

RESULTS

Summary of findings by plot follows.

Copeland Creek

Of the 100 trees selected for study, 62 percent were subalpine fir and 38 percent Shasta fir (table 1). The subalpine firs were predominantly in the codominant and intermediate crown classes (87 percent), while the Shasta firs were mainly larger, faster growing trees in the dominant and codominant classes (89 percent).

Chermes bole infestations and gouting were found on both tree species. Bole infestations occurred on 95 percent of the subalpine fir and 21 percent of the Shasta fir plot trees (table 2). Of the infested subalpine firs, 79 percent were heavily infested while all Shasta fir infestations were of a light intensity. Live chermids were found under the waxy masses on both species. Gouting was observed on 95 percent of the subalpine firs, 48 percent of the trees showing heavy damage (table 3). Twenty-six percent of the Shasta firs were gouted. Although no heavy damage was observed, one tree showed moderate gouting. Most of the observable damage to the red firs occurred in the lower crown. Top kill was detected in 13 percent of the subalpine firs with the amount of kill ranging from 5-100 percent of the total crown with two trees dead in 1964. No Shasta red fir crowns had been killed.

Trapper Creek

Subalpine fir was also the predominant tree species at Trapper Creek, making up 64 percent of the plot trees (table 1). Almost 58 percent of the subalpine firs were in the dominant and codominant crown classes, while 58 percent of the Shasta firs were in these two classes--so the plot trees were generally comparable in height.

Chermes has probably not been active in this area long. One-third of the subalpine firs had bole infestations, while no populations were detected on the Shasta firs (table 2). Heavy trunk infestations were observed on 23 percent of the subalpine firs. No gouting was seen on any of the plot trees, but one subalpine fir had 80 percent of its top killed (table 3). No tree mortality was noted on the plot.

Red Blanket Creek

Trees on this plot were small and showed the characteristics of true firs growing at a high elevation and/or on a poor site. The stand was basically composed of Shasta red fir (table 1). Of the 100 plot

trees selected, 71 were Shasta firs--73 percent being in the upper two crown classes. The subalpine firs were again slightly smaller with 75 percent of them in the codominant and intermediate classes.

No Chermes-infested or gouted trees were found on or near the plot area regardless of tree species (tables 2 and 3). It is very possible that the aphid has not penetrated this far south.

IMPLICATIONS

Apparently, the balsam woolly aphid will cause heavy damage to subalpine firs on the Copeland Creek plot. If intensification occurs on the Trapper Creek plot, most or all of the subalpine firs will probably be seriously damaged. It will be interesting to see if or when the aphid will spread south to the Red Blanket Creek plot.

Chermids have definitely become established on the bole of some of the Shasta red firs on the Copeland Creek plot. Trees in all three areas should be watched closely until the aphid population subsides to see if any Shasta red firs are killed by the aphid, and, if so, in what ratio to the number of subalpine firs killed.

RECOMMENDATIONS

1. A two-man crew should rate these plots annually.
2. Plots should be established in several adjacent stands containing very little, if any, subalpine fir to see if Shasta red fir can sustain an aphid infestation by itself.

Table 1.--Crown classes of Chermes trend plot trees by species
on three plots in Crater Lake National Park, Oregon

Plot	Number of plot trees in each crown class by species									
	Subalpine fir					Shasta red fir				
	D	CD	I	S	Total	D	CD	I	S	Total
	:	:	:	:	:	:	:	:	:	:
Copeland Creek	5	28	26	3	62	19	15	4	0	38
Trapper Creek	21	16	21	6	64	17	4	14	1	36
Red Blanket Creek	7	12	10	0	29	22	30	19	0	71
Total	33	56	57	9	155	58	49	37	1	145

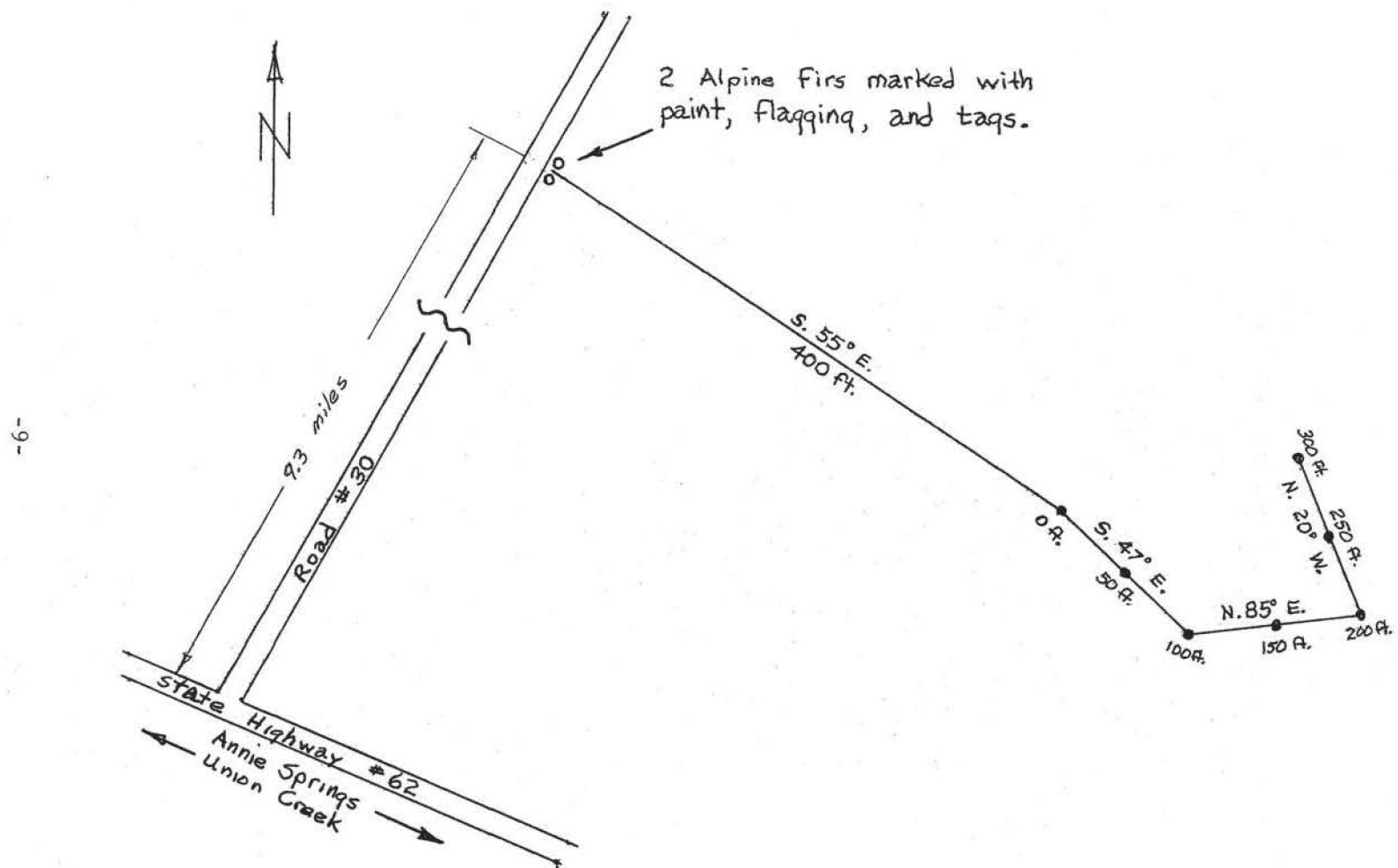
Table 2.--Occurrence and density of Chermes bole infestations by tree species
on three trend plots in Crater Lake National Park, Oregon

Plot	Number of trees with Chermes bole infestations by intensity and species									
	Subalpine fir					Shasta red fir				
	None	Light	Moder-	Heavy	Total	None	Light	Moder-	Heavy	Total
	:	:	ate	:	:	:	:	ate	:	:
Copeland Creek	3	6	4	49	62	30	8	0	0	38
Trapper Creek	42	3	4	15	64	36	0	0	0	36
Red Blanket Creek	29	0	0	0	29	71	0	0	0	71
Total	74	9	8	64	155	137	8	0	0	145

Table 3.--Occurrence and intensity of Chermes-caused gouting on three trend plots in Crater Lake National Park, Oregon

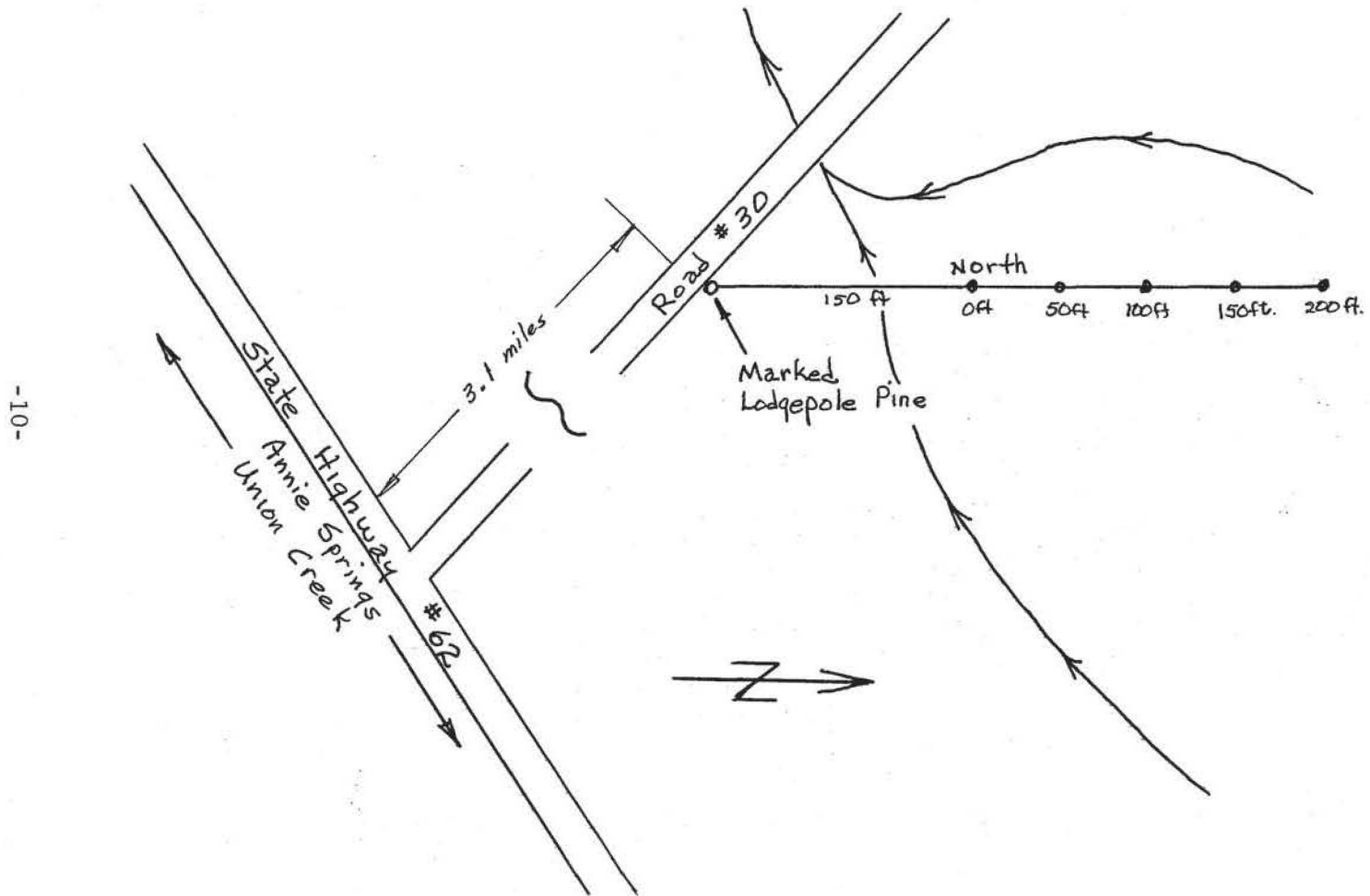
Plot	Number of trees gouted by Chermes by intensity and species									
	Subalpine fir					Shasta red fir				
	None	Light	Moder-	Heavy	Total	None	Light	Moder-	Heavy	Total
	:	:	ate	:	:	:	:	ate	:	:
Copeland Creek	3	7	22	30	62	28	9	1	0	38
Trapper Creek	64	0	0	0	64	36	0	0	0	36
Red Blanket Creek	29	0	0	0	29	71	0	0	0	71
Total	96	7	22	30	155	135	9	1	0	145

COPELAND CREEK CHERMES TREND PLOT



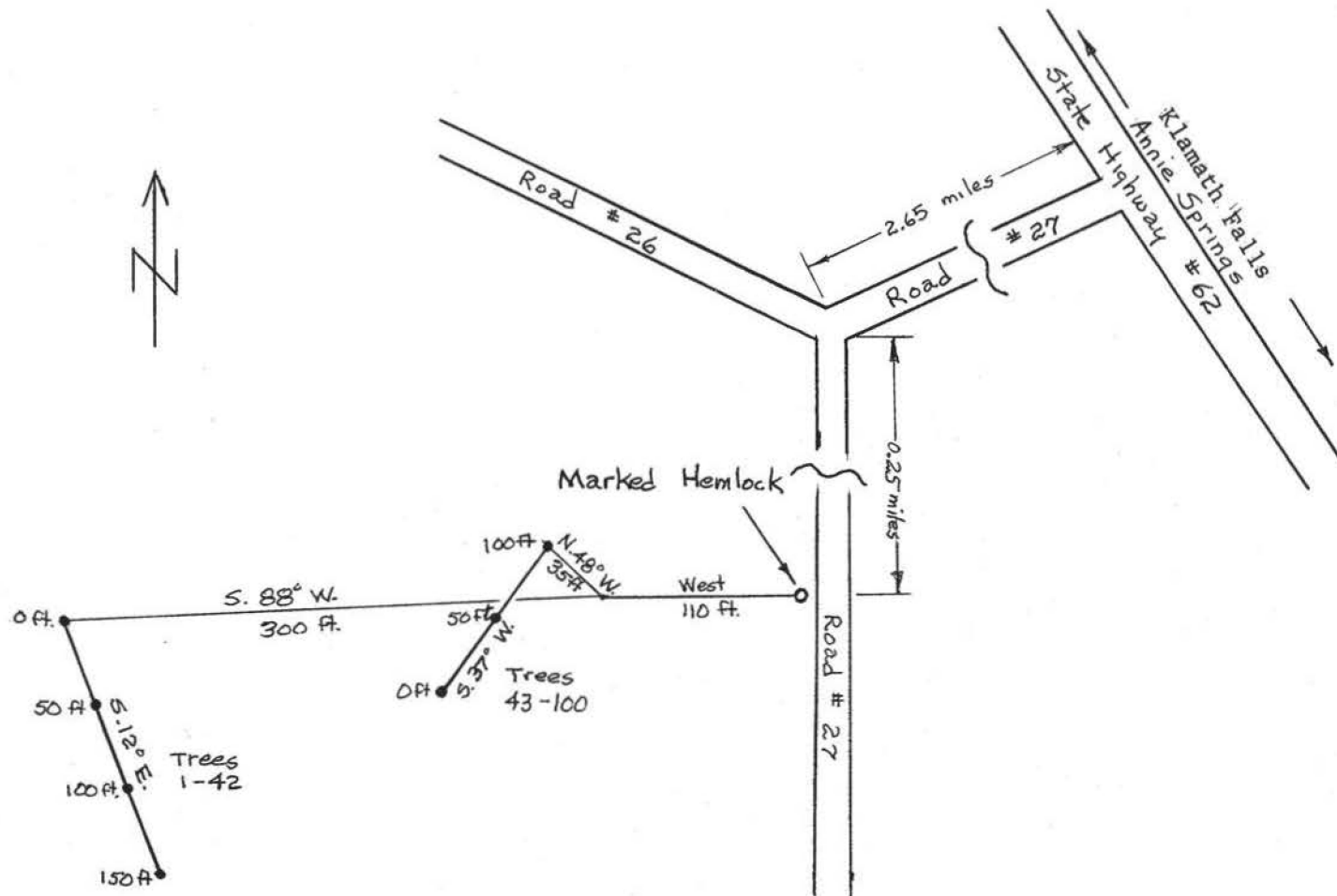
Established 9-23-64

TRAPPERS CREEK CHERMES TREND PLOT



Established 9-22-64

RED BLANKET CREEK CHERMES TREND PLOT



Established 9-24-64